

WHAT IS CLAIMED IS:

1. A device for detecting a selected analyte, comprising:
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a stably transformed bacterium containing a promoterless *lux* gene cassette having a regulatory element for a selected analyte inserted in front of the *lux* gene cassette;
a support matrix onto which the bacterium is attached; and
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an encapsulating material to contain said bacterium attached to the support matrix
wherein the encapsulated bacterium emits visibly detectable light in the presence of the selected analyte.
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2. The device of claim 1 wherein the *lux* gene cassette comprises *merRo/p-lux*.
3. The device of claim 2 further comprising a *merRo/pA-lux* gene cassette incorporated into the transformed bacterium.
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4. The device of claim 1 wherein the analyte is naphthalene, toluene, ethylbenzene, 2,4-dichlorophenoxyacetic acid, β -phenyl ethylamine, phenol or biphenyl.
5. The device of claim 1 wherein the analyte is mercury.
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6. The device of claim 1 wherein the regulatory element comprises a *mer* regulatory element.
7. The device of claim 4 wherein the regulatory element further comprises a *mer* operator.
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8. The device of claim 1 wherein the bacterium is *P. fluorescens*.
9. The device of claim 6 wherein the *P. fluorescens* is *P. fluorescens* 5R.

10. An apparatus comprising the device of claim 1.
- 5 11. The apparatus of claim 10 comprising a holder for the support matrix onto which the bacterium is immobilized.
12. The apparatus of claim 11 adapted to hand-carrying.
- 10 13. A genetically modified bacterium responsive to divalent mercury, said bacterium containing a *merRo/p-lux* gene stably integrated into the bacterial chromosome wherein said bacterium produces a bioluminescent protein in the presence of divalent mercury.
14. The genetically modified bacterium of claim 13 that is encapsulated.
- 15 15. The genetically modified bacterium of claim 14 that is encapsulated in a matrix selected from the group consisting of alginate, carrageenan, acrylic vinyl acetate copolymer, latex, polyvinyl chloride polymer, sol-gels, agar, agarose, micromachined nanoporous membranes, polydimethylsiloxane (PDMS), polyacrylamide, polyurethane/polycarbamyl sulfonate and polyvinyl alcohol.
- 20 16. The encapsulated genetically modified bacterium of claim 14 that is attached to a support matrix.
- 25 17. The encapsulated genetically modified bacterium of claim 16 wherein the support matrix is cellulose, glass, colloidal noble metal, plastic, laminin or resin.
- 30 18. A cellulose support comprising the genetically modified bacterium of claim 13.
19. A kit for detecting mercury II ion comprising the genetically modified bacterium of claim 13 adhered to an immobilization support and instructions for use in detecting mercury ion.
- 35 20. The kit of claim 19 further comprising a second genetically modified bacterium harboring a stably integrated *merRo/pA-lux* gene.
21. The kit of claim 19 or claim 20 further comprising a direct visual assistance device.

22. The kit of claim 21 wherein the direct visual assistance device is a light-tight box or night vision goggles.

5 23. The kit of claim 19 or 20 wherein the genetically modified bacterium is *P. putida* 2440, *P. fluorescens* 5R, *P. putida* F1, *Escherichia coli*, *Vibrio fischerii*, *Vibrio harveyi*, or *Bacillus subtilis*.

24. The kit of claim 23 wherein the bacterium is *P. fluorescens* 5R.

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25. A method for detecting mercury comprising

contacting a sample suspected of containing mercury II ion with a bioreporter bacterium genetically modified to contain a *merRo/pA-lux* gene; and

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detecting the presence of the mercury ion when a visibly detectable luminescence is produced.

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26. The method of claim 25 wherein the bioreporter bacterium is *E. coli* ARL1, ARL2 or ARL3.

27. The method of claim 25 wherein the bioreporter is encapsulated or immobilized.